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# THE MICA INDUSTRY IN THE SOVIET BLOC

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THE MICA INDUSTRY IN THE SOVIET BLOC\*

Summary

Mica is an essential material in the manufacture of communications and automotive equipment and in the guided missile and aircraft industries. Although substitute materials have displaced mica in some of its uses, sheet mica, film mica, and mica splittings\*\* are still indispensable to the electrical and electronics industries of the Soviet Bloc.

The USSR is the major producer of mica in the Soviet Bloc. Of the total estimated Bloc production of 31,600 metric tons\*\*\* in 1954, the USSR produced 30,000 tons. It is estimated that in 1955 the USSR will produce 31,000 tons of the Bloc total of 32,700 tons. Bulgaria, Rumania, and Communist China will produce the remainder.

Of the total mica produced in the Soviet Bloc, only about 10 percent is of a quality high enough to be used in the electrical and electronics industries, and of this relatively high-quality mica only from 10 to 15 percent is of strategic grades.\*\*\*\* Of the total 1955 production of mica in the Bloc, then, only about 3,270 tons will be usable in the electrical and electronics industries and only about 400 tons will be of strategic grades.

Soviet Bloc requirements for strategic grades of mica in 1955 are estimated at about 880 tons. Total Bloc production of these strategic grades in 1955 will approximately meet the requirements of the USSR.

\* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 December 1954.

\*\* For specifications of these grades, see Appendix B.

\*\*\* Throughout this report, tonnages are given in metric tons.

\*\*\*\* Strategic grades of mica are those grades of sheet mica and film mica which meet the high specifications established by the manufacturers of electron tubes and condensers.

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The European Satellites and Communist China will be dependent on non-Bloc sources for their supplies of strategic grades, as they have been in the past. India, the chief Free World exporter of mica to the Bloc, can supply their requirements.

The major mica deposits in the Soviet Bloc are in the USSR, Communist China, Bulgaria, and Rumania. Although large-scale production is now confined to the USSR, the Bloc has unmined reserves which, if exploited, would meet all mica requirements of the Bloc. Adequate exploitation could be accomplished by increasing the relatively small inputs of manpower, fuel, and electric power now employed. As of mid-1954 the labor force engaged in the production of mica in the Bloc is estimated at about 15,000. The USSR alone could easily double that labor force.

The mining of mica is done primarily in small, open-pit mines, rather widely scattered. Although the mines themselves are not vulnerable, the few mica-processing plants are concentrated in the Moscow-Leningrad and Krasnoyarsk-Irkutsk areas, and this concentration presents some vulnerability. Because of the specialized equipment used in the mica-processing plants, the manufacture of replacement parts would be difficult under wartime pressures. Under present mining and processing conditions -- and in view of the dependence of the European Satellites and Communist China on non-Bloc sources of strategic grades of mica -- those Soviet Bloc industries in which mica is an essential material are in a vulnerable position.

The mica industry in the Soviet Bloc is an indicator of intentions only to the extent that a marked increase in the production or imports of strategic grades of mica might indicate increased manufacture of small electron tubes for use in field radios, proximity fuses, and guided missiles.

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## I. Introduction.

### A. General.

Certain sizes of the better grades of sheet mica are essential materials in the electrical and electronics industries of the Soviet

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Bloc. Mica is of particular importance in the manufacture of electronics equipment, which is required in great quantities in time of war. 1/\*

Substitutes for mica in some of its uses have been developed, but sheet and film mica and mica splittings are still necessary materials in the electrical and electronics industries. 2/

Mica is mined in the USSR, as it is in other countries, in shallow, open-pit mines. Because of the erratic occurrence of the better grades of mica, large-scale mechanical methods of mining and reparation are impracticable. Mica is mined as block mica or scrap mica, and about 10 percent of the total mica mined consists of sheet and film mica\*\* and mica splittings\*\*\* of grades high enough for use in the electrical and electronics industries.

#### B. History and Significance of the Industry.

Modern mining of mica in the USSR, the only country in the Soviet Bloc with a significant mica industry, began about 1926, and by 1929 production had increased to the point where the USSR was self-sufficient and had a small surplus for export. The production of ground mica for use in the rubber and asphalt industries began in the mid-1930's.

Production of mica reached about 13,000 tons\*\*\*\* at the beginning of World War II, 3/ when several of the processing plants near Leningrad were destroyed.

The importance of mica to the Soviet economy was indicated in the Third Five Year Plan (1938-42), which set a production goal of 5,000 to 30,000 tons of all grades of mica. Later, the same goal was set for 1950, but the total production of mica did not reach 30,000 tons until 1953 (see Table 1\*\*\*\*\*).

\* For serially numbered source references, see Appendix E.

\*\* Sheet and film mica are used in electron tubes, condensers, and the like.

\*\*\* Mica splittings are used for insulation in electrical equipment, heating devices, and the like.

\*\*\*\* None of the data in this report represents weighed or measured quantities. The figures are estimates or approximations based on available information interpreted in the light of the experience of the analyst. Estimates have a range of error of plus 5 to minus 20 percent.

\*\*\*\*\* P. 7, below.

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The industrial significance of mica was relatively slight until 1923, when the modern electron tube industry began. As the production of electric motors, transformers, and generators increased and the telephone and radio industries expanded, requirements for mica, an essential component in the manufacture of electrical equipment, also increased. Apparently the growth not only of the electrical industry but also of those industries employing electrical equipment -- the automotive, shipping, aircraft, and precision instrument industries -- can be gauged by the consumption of mica. 4/

C. Uses of Mica.

The perfect cleavage, flexibility, chemical and physical stability, transparency, high dielectric strength, and luster of mica make it serviceable in many industries.

The first modern uses for sheet mica were for stove and battleship windows and for lamp shades. The most important modern uses, however, are in the electrical industry, which expanded greatly with the invention of built-up mica. This product is made of mica splittings cemented by shellac or resin, and it can be made into sheets of almost any desired size. The sheets can be milled to uniform thickness or can be made into tubes of many and varied shapes. The electrical uses for sheet and built-up mica include insulating rings, sleeves, bushings, and commutator-segment insulation in electric motors, and components in generators, condensers, electric light bulbs, electron tubes, fuses, and heating elements of flat irons. The electrical industry 5/ accounts for about 90 to 95 percent of the block, sheet, and film mica and mica splittings consumed annually. 6/ Ground mica made from the waste in trimming sheet mica and from the milling of imperfect and folded sheet mica, as well as fine-grained mica obtained from mica schist, became of importance in the USSR in the 1930's as the demand by the rubber, paint, and wallpaper industries increased.

A list of the possible uses for sheet and ground mica and

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mica splittings in the USSR is presented below:

<u>Uses</u>	<u>Types</u>
<u>Essential</u>	
Electrical insulation	Splittings
Electron tubes	Sheet and film
Condensers	Sheet and film
<u>Less Essential</u>	
Stove fronts	Sheet
Lamp chimneys	Sheet
Shades	Sheet
Electrical heating devices	Splittings and built-up mica board
Pipe and boiler covering	Ground
Roofing material	Ground
Annealing agent for steel	Ground
<u>Nonessential</u>	
Phonograph discs	Sheet
Paint manufacture	Ground
Filler in rubber	Ground
Decoration and wallpaper	Ground

The essential uses to which mica is undoubtedly put in the USSR correspond closely to, and include, the strategic uses. Strategic uses may be classified as those in which mica is used by the radio, radar, telephone, automotive, aircraft, and guided-missile industries for military purposes. The less essential uses in the USSR are assumed to be the common uses to which mica may be put in any country which uses mica in quantities, and nonessential uses include all other possible uses which might be made of mica.

Information on the quantities consumed in each use in the USSR is not available. It is estimated, however, that the pattern of essential and strategic uses is essentially the same in the US and the USSR. The less essential and nonessential uses account for a much smaller percentage of total consumption in the USSR than in the US because

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these uses represent, for the most part, civilian consumer items which are produced on a relatively minor scale in the USSR.

For some of the uses of sheet mica, film mica, and mica splittings it is possible to employ substitute or alternate materials such as ceramics, glass, paper, rubber, silicone resins, plastics, and synthetic mica. Paper is still the chief substitute for mica. Improvements in the design of some communications equipment have made possible the use of lower grades of sheet mica in uses where previously only the highest grades were specified. In the US, Western Europe, and the USSR, long strips of "sheet mica" have recently been developed, utilizing the large quantities of scrap mica available. Although this product is a suitable substitute for mica splittings, it cannot take the place of high-grade sheet mica in condensers and electron tubes.

Information on the quantitative reduction in mica requirements effected by substitutes in the Soviet Bloc is not available. Reports on the production and consumption of mica and descriptions of captured radio and aircraft equipment indicate, however, that the amount of materials substituted for mica is relatively small at present but is increasing.

## II. Production and Unmined Reserves.

### A. Production.

Total 1954 production of mica in the Soviet Bloc is estimated at 31,600 tons. Of this total, the USSR produced about 30,000 tons; Communist China, about 750 tons; Rumania, about 500 tons; and Bulgaria, about 350 tons. Because of the extreme variation in the value of the various grades of mica produced, total production figures are actually of little significance. Changes in total production over a period of years, however, are significant as general indicators of the consumption of mica in the electronics and electrical industries. Estimated production of mica in the Soviet Bloc in 1936-55 is shown in Table 1.\*

Because of the erratic occurrence of mica in the matrix, most mica mines are small, open-pit operations and have a relatively short

\* Table 1 follows on p. 7.

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Table 1  
Estimated Production of Mica  
in the Soviet Bloc 7/  
1936-55

					Metric Tons
Year	USSR	Communist China	Bulgaria	Rumania	Total
1936	11,235	210	0	67	11,512
1937	11,000	220	0	27	11,247
1938	10,500	240	0	22	10,762
1939	12,900	330	0	18	13,248
1940	12,700	360	0	174	13,234
1941	12,000	390	0	125	12,515
1942	8,000	800	0	116	8,916
1943	6,500	1,000	0	628	8,128
1944	5,500	1,000	0	500	7,000
1945	9,000	500	0	250	9,750
1946	10,000	0	0	250	10,250
1947	12,000	0	0	300	12,300
1948	14,000	0	0	350	14,350
1949	15,000	500	0	400	15,900
1950	19,000	550	0	450	20,000
1951	25,000	600	200	500	26,300
1952	28,000	700	300	500	29,500
1953	30,000	750	350	500	31,600
1954	30,000	750	350	500	31,600
1955	31,000	800	400	500	32,700

life. When a pocket of mica has been fully exploited, the mining or quarrying operation moves to another location. Mica mining operations are best described in terms of areas or regions which contain numerous exploitable mica deposits.\*

The largest and richest single mica-producing area in the USSR is the Mama River district in East Siberia (Economic Region XI\*\*). 8/

\* See the map, Soviet Bloc: Mica Mines and Processing Plants, following p. 20.

\*\* The term region in this report refers to the economic regions defined and numbered on CIA Map 12048.1, 9-51 (First Revision, 7-52), USSR: Economic Regions.

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It is located northeast of the northern end of Lake Baikal and covers an area of about 6,000 square kilometers. Second in importance in the production of mica is the area of the Biryusa deposits, located at the headwaters of the Biryusa River on the eastern slope of the Sayan Mountains. Although this area is considerably smaller than the Mama River district -- the richer deposits cover an area of only 300 square kilometers -- the potential deposits and the percentage of usable sheet mica are greater than in any other area in the USSR. The third most important mica mining area in the USSR -- also in East Siberia -- is the Kondakovskiy area in Krasnoyarskiy Kray, located on the right bank of the Taseyeva River in the South Yeniseyskiy Mountain range.

Two other important mica-producing areas in East Siberia are the Slyudyanka and Aldan River districts. The former, with four mines operating, was the largest producer of mica in the USSR until 1937. The Aldan River fields were discovered in 1942, and by 1944 there were 19 mines operating in the area. The other mica fields in the USSR which are steady producers are the Karelia and Kola Peninsula districts (Economic Region Ia) and the Ural Mountain fields (Economic Region VIII). Mica deposits and some small intermittent production have been reported in the Ukraine, the Caucasus, and the Pamir Mountain area.

In Rumania the deposits of mica are located in the Brezoiu district, and although the deposits are small, they contain some good grades of block mica. 9/ Production has only recently been reported in Bulgaria, where the mines are located in the south central part of the country. The known deposits of mica in Communist China 10/ to date have yielded only small production of inferior grades of mica. The best deposits are located in Suiyuan Province in the North China area.

A list of the mica mines and mining areas in the Soviet Bloc is given in Appendix A.

Most of the mica mined in the Soviet Bloc is scrap mica, which can be used only to produce ground mica. The production of block mica suitable for processing to sheet and film mica and mica splittings varies from 5 to 15 percent of the total production.

In 1929 the Director of the Geological Committee of the USSR stated that only about 10 percent of the mica produced in the Soviet Bloc was block mica. 11/ More recent reports show that the percentage of block mica recovered was from 1 to 3 percent in the Urals and the Kola Peninsula, 10 percent in the Biryusa and Mama River fields, and

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12 percent in the Slyudyanka fields. <sup>12/</sup> A survey of the evidence indicates that 10 percent of the total mica produced annually in the Bloc is raw block mica from which sheet and film mica and mica splittings may be processed. The estimated production of block and film mica and mica splittings in the Bloc in 1950-55 is shown in Table 2.

Table 2

Estimated Production of Block and Film Mica and Mica Splittings  
in the Soviet Bloc  
1950-55

			Metric Tons
Year	Total Block and Film <sup>a/</sup>	Block and Film of Strategic Grade <sup>b/</sup>	Splittings <sup>c/</sup>
1950	2,000	200 to 300	1,600
1951	2,630	260 to 390	2,100
1952	2,950	300 to 440	2,360
1953	3,160	320 to 470	2,530
1954	3,160	320 to 470	2,530
1955	3,270	330 to 490	2,620

a. Ten percent of total production as given in Table 1.

b. Ten to 15 percent of total block and film.

c. Eighty percent of total block and film. There is some loss of mica in processing. For methodology, see Appendix C.

B. Unmined Reserves.

Before actual exploitation, it is impossible to determine within reasonably narrow limits the quality, quantity, and size of the block mica contained in a deposit. Consequently, any reserve figures reported must be rough approximations without breakdown by grades. Reserves have been classified by the USSR in the following five categories: <sup>13/</sup>

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- A. Thoroughly explored reserves ready for mining.
- A<sub>2</sub>. Thoroughly explored reserves serving as a basis for the planning and construction of mines.
- B. Reserves geologically explored and defined by tests, with preliminary examinations completed on composition and characteristics of material.
- C. Reserves established by geological investigations based on natural or artificially induced appearance of the material on the surface.
- C<sub>2</sub>. Reserves geologically substantiated but not yet clearly defined and distributed over an entire district or basin.

Similar categorical breakdowns of the reserves of Communist China, Bulgaria, and Rumania are not available.

Reserves of mica in the USSR in 1939 were estimated at 20 million tons. Of this total, only 100,000 tons were specified by category -- 15,000 tons as A and A<sub>2</sub> and 85,000 tons as C and C<sub>2</sub>. <sup>14/</sup> Reserves in Communist China have been estimated at from 250,000 to 300,000 tons. <sup>15/</sup> Estimates of the mica reserves in Bulgaria and Rumania are not available, but geological evidence indicates that they are small. Assuming that geological exploration in the USSR and Communist China has continued systematically, it is estimated that total 1954 unmined reserves of mica in the Soviet Bloc are from 18 million to 20 million tons. Of these total reserves, from 10 million to 12 million tons are probably recoverable. As only about 10 percent of the recoverable mica is block mica, the total unmined reserves of block mica in the Bloc in 1954 are estimated at 1 million tons.

### III. Other Major Resources.

Detailed information on manpower, transportation, electric power, and fuel in the mica industry in the Soviet Bloc is not available, but some estimates of the requirements can be given.

The total manpower requirements are estimated at about 15,000.\* Of this total, about 10,600 are employed at the mines, and 4,400 are

\* For methodology, see Appendix C.

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Table 3

Estimated Consumption of Strategic Grades of Mica  
in the Soviet Bloc, by Product and Classification a/  
1954

Product	Percent	
	Classifications (1) through (5) <u>b/</u>	Classification (6) <u>b/</u>
Radio condensers	79	13
Radio tubes	1	67
Other radio parts	1	3
Magnetos	10	1.5
Spark plugs	6	13
Gauge glass	1.5	1.5
Other	1.5	1
Total	<u>100.0</u>	<u>100.0</u>

a. For methodology, see Appendix C.

b. See text above.

The manufacture of electron tubes and condensers consumes about 80 percent of the strategic grades of block and film mica used in the Soviet Bloc. The electron tube industry in the Bloc is located for the most part in the USSR, Hungary, East Germany, and Czechoslovakia; the Satellites account for about 37 percent of the total consumption of mica in electron tubes. The manufacture of condensers is confined largely to the USSR, Czechoslovakia, and East Germany; the Satellites account for about 21 percent of the total consumption of mica in condensers. Estimated consumption of strategic grades of block mica and film mica in the Bloc in 1950-55 is shown in Table 4.\*

Mica splittings are consumed in the manufacture of built-up mica, which is produced in two forms -- built-up board and tape. The board is used in commutator segments; in rings for generators and starters in aircraft, tank, and automobile engines; in industrial motors and generators; and in fractional horsepower motors. Tape is used in armature in insulation in high-voltage generators, industrial motors,

\* Table 4 follows on p. 13.

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Table 4  
Estimated Consumption of Strategic Grades of Block and Film Mica in the Soviet Bloc a/  
1950-55

Metric Tons														
Year	Electron Tubes						Condensers				Consumption in Total Tubes and Condensers		Total Consumption of Block and Film b/	
	USSR	Hungary	Czecho- slovakia	East Germany	All Other Satellites	Total Satellites	Total Bloc	USSR	East Germany	Czecho- slovakia	Total Satellites	Total Bloc		
1950	130	45	14	11	5	75	205	90	6	22	28	118	323	400
1951	150	32	10	16	5	63	213	116	10	30	40	156	369	460
1952	188	41	20	24	5	90	278	161	11	14	25	186	464	580
1953	213	63	25	29	5	122	335	154	12	31	43	197	532	660
1954	244	81	34	57	5	177	421	167	13	33	46	213	634	790
1955	263	95	42	75	5	217	480	180	14	34	48	228	708	880

a. For methodology, see Appendix C.  
b. Includes utilizations of block mica and film mica.

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and small transformers. A breakdown on the percentages consumed for each use of built-up mica is not available.

Estimated Soviet Bloc requirements for strategic grades of block mica, film mica, and mica splittings in 1950-55 are shown in Table 5.

Table 5

Estimated Soviet Bloc Requirements  
for Strategic Grades of Block and Film Mica and Mica Splittings a/  
1950-55

			Metric Tons
<u>Year</u>	<u>Block and Film Mica</u>	<u>Mica Splittings</u>	<u>Total</u>
1950	400	800	1,200
1951	460	920	1,380
1952	580	1,160	1,740
1953	660	1,320	1,980
1954	790	1,580	2,370
1955	880	1,760	2,640

a. For methodology, see Appendix C.

Estimated 1953 production of block and film mica of strategic grades in the Soviet Bloc was from 320 to 470 tons (see Table 2\*), and estimated 1953 requirements of these grades in the Bloc were about 660 tons. An over-all deficit for the Bloc as a whole is indicated. The 1953 production of mica splittings, on the other hand, is estimated at 2,530 tons, substantially more than the estimated 1953 requirements of 1,980 tons.

The Soviet Bloc deficit in strategic grades of block and film mica probably forces the European Satellites to depend upon imports from the Free World for most of their requirements for those grades. Of the total 1953 Bloc production of the strategic grades, the European Satellites combined produced only about 10 tons. The manufacture of

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electron tubes and condensers in the European Satellites in 1953 required about 165 tons. Production of the strategic grades in the USSR in 1953, from 300 to 450 tons, was approximately adequate for 1953 Soviet requirements of 367 tons for consumption in electron tubes and condensers (see Table 4\*). The USSR, obviously, could have supplied virtually none of the European Satellite requirements, and the Chinese Communist production in 1953 of about 10 tons could not have altered the situation materially. If 1953 production of the strategic grades of mica in the USSR was near the lower limit of the estimate, 300 tons, it is likely that the USSR, as well as the European Satellites, was forced to import mica from the Free World. There is no indication that stockpiles of strategic grades of mica exist in the Bloc, and it is likely that stocks other than working inventories in the electron tube and condenser plants are very small.

#### V. Trade.

Reliable quantitative statistics on Soviet Bloc trade in mica are not available. There are, however, some fragmentary data of significance. Communist China recently placed an order for 10 million rupees (US \$2.1 million) worth of mica from India. 18/ This is considerably above the value of annual purchases during the 1947-50 period, and it may be assumed that a part of this mica from India is intended for use in the USSR and, possibly, the European Satellites. There are some scraps of information indicating purchases of unprocessed sheet mica, 19/ mica splittings, 20/ unfinished sheet mica, 21/ and other mica from India. 22/

Reports of 1953 exports of mica from India 23/ give an incomplete breakdown by grade and country of destination:

	<u>Czechoslovakia</u>	<u>Poland</u>	<u>East Germany</u>	<u>Hungary</u>	<u>Total</u>
	(Metric Tons)				
Block mica	12	2	4	3	21
Mica splittings	18	32	0	0	50
Total	<u>30</u>	<u>34</u>	<u>4</u>	<u>3</u>	<u>71</u>

\* P. 13, above.

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Although no firm conclusions can be drawn from such fragmentary data, it appears that Poland and Czechoslovakia were the chief European Satellite importers of block mica and mica splittings in 1953.

VI. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

The USSR and Communist China have large unmined reserves of mica which are adequate for all Soviet Bloc requirements for many years. The possibilities of expansion of present production to satisfy all demands, therefore, are controlled largely by the number of men and the quantity of equipment allocated to the industry. Both mining and processing are largely hand operations; so, except for relatively small quantities of specialized equipment in the processing plants, the major need in the expansion of the mica industry is for manpower -- a need which could easily be satisfied.

B. Vulnerabilities.

Because most of the mica mines in the Soviet Bloc are small, open-pit operations scattered over wide areas, the mica mining industry itself is not vulnerable. The plants which process the mica, however, are concentrated in the Moscow-Leningrad area and at Irkutsk, Nizhneudinsk, and Zaozernaya. Because of the specialized equipment used in these plants, the allocation of material for and the manufacture of replacement parts would be difficult under wartime conditions. Considering present mining and processing practices, the potential deficit position of the Bloc, and the dependence of the European Satellites on imports, it appears that the radio, electronics, and automotive industries which are dependent on mica are in a potentially vulnerable position.

C. Intentions.

A large increase in Soviet production and European Satellite imports of high-quality, small-size block and sheet mica could be an indication of increased production of electron tubes of the sizes required for use in proximity fuses, guided missiles, and small field radio sets used by the armed forces of the Soviet Bloc.

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APPENDIX A

MICA MINES AND PROCESSING PLANTS IN THE SOVIET BLOC

Mica Mines

1. USSR 24/

Economic Region Ia.

Loukhi to Chupa area	66° 05' to 10'N - 33° 05' to 20'E
Slyudorazrabotoki	66° 41'N to 37° 56'E
Kirovsk	67° 37'N to 33° 39'E
Kandalaksha	67° 09'N to 32° 26'E
Belomorsk	64° 32'N to 34° 48'E

Economic Region VIII.

Urals' mineralized zone on the east slope, 450 kilometers long and 50 kilometers wide; includes over 30 openings.

Kyshtym	55° 44'N to 60° 35'E
Ufalet	55° 54'N to 60° 00'E
Mass	55° 02'N to 60° 06'E

Economic Region XI.

Mama-Vitim River District, 57° to 59° 00'N to 112° to 113° 30'E; includes about 30 operations.

Biryusa River District	55° 59'N to 97° 51'E
Kondakovskiye (4 to 5 operations)	70° 00'N to 152° 00'E
Kazachinskoye	57° 41'N to 93° 18'E
Kauusk	56° 13'N to 95° 40'E
Slyudyanka District (4 operations)	51° 38'N to 103° 40'E
Aldan River District (19 operations)	58° 37'N to 125° 24'E

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2. Communist China 25/

Economic Region I.

Mi-shan	45° 30'N to 132° 00'E
Chi-an	41° 06'N to 126° 10'E
Kai-p'ing	40° 24'N to 112° 33'E
Liao-yang	41° 17'N to 123° 11'E

Economic Region III.

Hsing-lung	40° 28'N to 117° 28'E
Mi-yun	40° 22'N to 116° 49'E
P'ing-shan	38° 15'N to 114° 12'E
Suiyuan Province	
Feng-chen (2 operations)	40° 28'N to 113° 08'E
Hsing-ho	40° 52'N to 113° 58'E
Chi-ning (2 operations)	40° 57'N to 113° 02'E
Kuei-sui	40° 47'N to 111° 37'E
Ku-yang	41° 08'N to 110° 10'E

Economic Region IV.

Chi-mo	36° 23'N to 120° 27'E
Tung-hai	34° 34'N to 119° 08'E
Ku-t'ien	26° 35'N to 118° 51'E

Economic Region VI.

Tan-pa	30° 57'N to 101° 55'E
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3. Bulgaria 26/

Gradevo	41° 54'N to 23° 11'E
Gostun	41° 49'N to 23° 43'E
Asenovgrad	41° 59'N to 24° 52'E

4. Rumania 27/

Brezoiu	45° 20'N to 24° 15'E
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ca Processing Plants

USSR 28/

Economic Region Ia.

Petrozavodsk	61° 49'N to 34° 20'E
Leningrad (2 plants)	59° 55'N to 30° 15'E

Economic Region X.

Irkutsk	52° 16'N to 104° 20'E
Nizhneudinsk	54° 54'N to 99° 03'E
Zaozernaya	55° 58'N to 94° 42'E

Communist China 29/

Economic Region III.

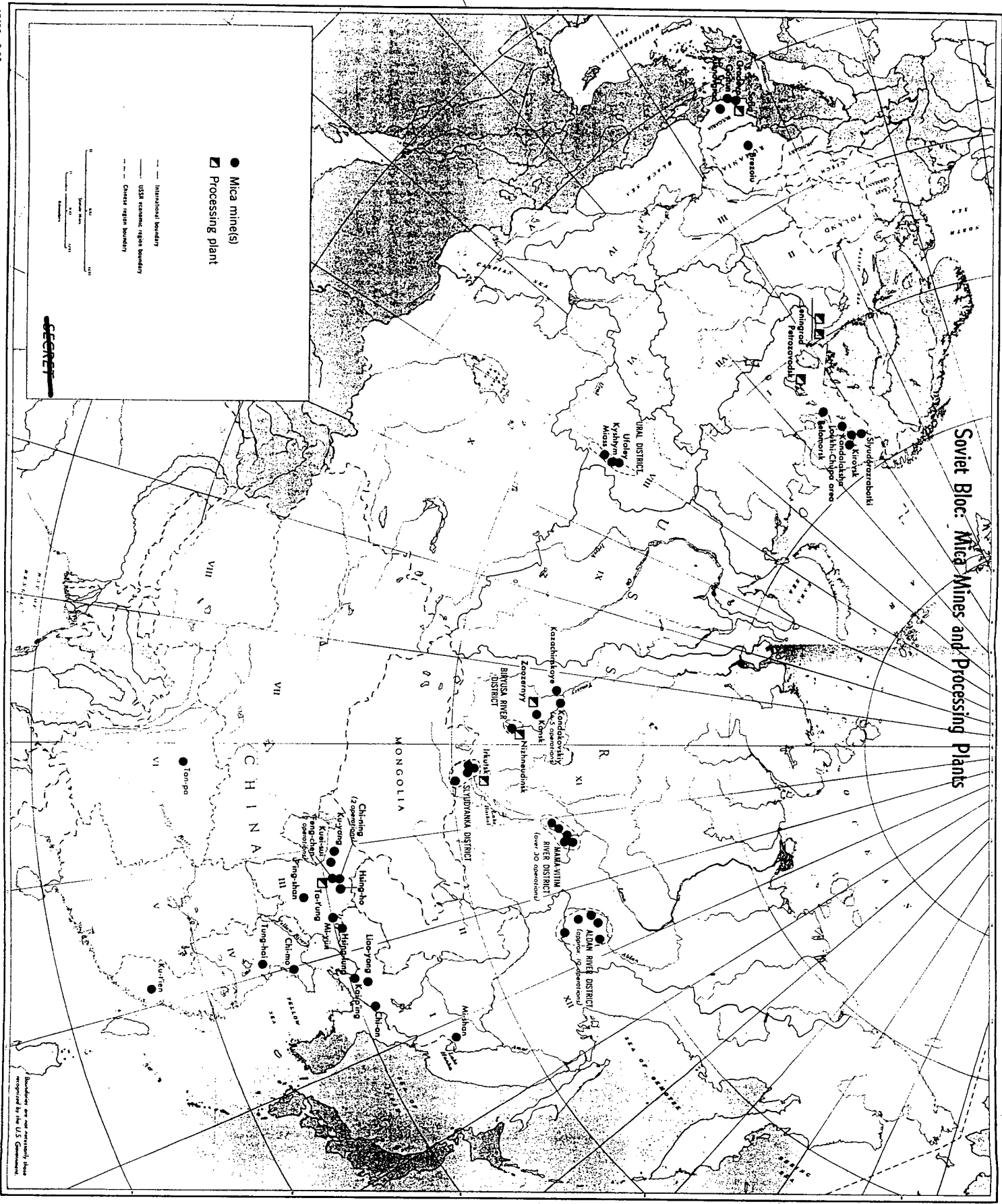
Ta-t'ung	40° 10'N to 113° 05'E
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Bulgaria 30/

Sofiya	42° 42'N to 23° 19'E
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# Soviet Bloc: Mica Mines and Processing Plants



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## APPENDIX B

### TECHNOLOGY

Sheet and film mica and mica splittings are marketed in a variety of sizes and qualities to fit the particular uses for which they are required. The proper preparation of block mica to produce sheet and film mica and mica splittings requires both good judgment in eliminating structural imperfections and inclusions and knowledge and experience in trimming, splitting, cutting, grading, and classification. The poorest quality in one classification approximately equals the best of the next inferior classification. Likewise, the largest size in one grade nearly equals the smallest size of the next larger grade.

The process of preparation of run of mica to the finished sheet, film, splittings, and scrap is a hand operation and encompasses five steps which are summarized briefly as follows:

First, the books or crystals of mica are hand-separated in the mine from the mica suitable only for scrap and from the adhering dirt and rock.

Second, the books are split into sheets, usually 0.007 inch and greater in thickness. The resulting product is untrimmed block mica of mixed sizes and scrap mica.

Third, the untrimmed block is sent to the trimmer shed, where ragged and tangled edges and cracked and stained portions are removed. Sheet mica split to a thickness of 0.004 to 0.007 inch in thickness is known as "thins," or "cigarette," mica. More scrap mica is accumulated at this stage also.

Fourth, this trimmed block or sheet mica is then graded to size, using a grading chart which was first used in India and which now has been accepted with slight variations in all the mica-producing countries of the world. The sizes range from 1/2 by 1/2 inch to special sizes of 8 by 10 inches to 12 by 14 inches for sheet mica; 1 by 1 inch to 2-1/2 by 4 inches for film, punch, and circle mica (sheet mica in circular shapes with diameters of 1 to 2-1/2 inches); and 1 by 1 inch to 2-1/2 by 4 inches in size for splittings. Mica splittings and film mica are made for the most part from the first few

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sheets on the top and bottom of the crystal or book of mica. These sheets are often more cracked and stained than the remainder of the book, and only a relatively small part of each sheet is usable. This serviceable part is then split to not more than 0.0012 inch in thickness for splittings and 0.0012 to 0.004 inch in thickness for film.

Fifth, after the mica has been graded to size and split to the required thickness, it is classified as to quality. There are six qualities into which each size is classified. These qualities are clear, clear and slightly stained, fair stained, good stained, stained, and black-stained or spotted, in descending order of insulating and dielectric qualities. Scrap mica is classified only as light or dark-colored scrap (indicating the occurrence of, or the lack of, the dark, iron-bearing minerals) and mine and factory scrap.

This exacting method of grading muscovite and phlogopite block and film mica and mica splittings is necessary because of the strict specifications for grades and classes of mica required in radios, radars, telephones, and other products of the electrical industry. The classifying of scrap is done because only the light-colored or low-iron muscovite scrap is suitable for the mixed mica and glass insulation bases for radio receiving sets utilized in some types of aircraft. Factory scrap resulting from the milling of built-up mica products is not usable for some ground mica products, because of the binders used in the built-up material.

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## APPENDIX C

### METHODOLOGY

Production figures for the USSR through 1939 and for Rumania through 1943 are reasonably reliable. Chinese production figures through 1945 are less reliable but are believed to be acceptable. Production figures for all countries of the Soviet Bloc after the several years reported above represent estimates obtained from various intelligence reports, as well as estimates based on technical experience. These estimates have been checked against the available geologic information on resources, unmined reserves, and requirements for finished mica products. It is believed that the totals reported are accurate within a margin of plus 5 to minus 20 percent.

The possible supply of block and film mica and mica splittings available from mica production in the Soviet Bloc shown in Table 2\* is based on the almost universally accepted opinion that block and film mica recovered makes up about 10 percent of the total mica recovered. Column 1 of Table 2 represents 10 percent of the total mica produced in the Soviet Bloc (as indicated in Table 1\*\*). From the information available on the mining and processing methods in the USSR, it is estimated that only 10 to 15 percent of the total block mica produced will meet specifications for strategic-grade mica. Possible splittings are calculated at 80 percent of the total production. The 5- to 10-percent difference between the strategic grades of block mica and mica splittings production is accounted for by a loss in processing the splittings and the block mica.

The consumption percentages shown in Table 3\*\*\* were obtained in the following manner. A check was made of US practices from the World War II period to date. This, in turn, was checked against information obtained from intelligence reports on Soviet practices and from CIA personnel who have had contact with European practices. On the basis of this information it was estimated that condensers and radio tubes in the USSR account for 80 percent of the consumption of strategic grades of block and film mica compared with the 83 to 85 percent consumed in the US. The remaining categories in the table --

- \* P. 9, above.
- \*\* P. 7, above.
- \*\*\* P. 12, above.

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with the exception of sparkplugs, which are believed to require a larger quantity of mica in the USSR than in the US -- closely follow the US pattern.

The estimates of mica consumption and requirements in the Soviet Bloc shown in Tables 4\* and 5\*\* were made in the following manner. It is known that the electrical and communications industry utilizes almost the entire supply of the strategic grades of block and film mica and mica splittings. The USSR also uses essentially the same type of electron tubes and condensers utilized in the US, 31/ and the percentages of the total mica consumed in tubes and condensers is comparable for the two countries. Radio electron tubes and condensers account for 80 to 83 percent of the consumption of the strategic grades of block and film mica in the US. An estimate of 80 percent of total consumption of strategic grades of mica by these two components has been assigned to the USSR. It is also estimated that one-third of the condensers manufactured in the USSR utilize mica in their construction.

Using the estimates of electron tube production and one-third of the condenser components produced in the Soviet Bloc 32/ and a factor of 10 pounds of mica per thousand tubes and 12 pounds of mica per thousand condenser units, the consumption of mica in the tube and condenser industries and the total mica required for all strategic uses were obtained. Again using US practices, the percentage of the total mica consumption accounted for by block and film mica and by mica splittings was utilized to obtain the estimate of the consumption and requirements of mica splittings in the Bloc. Consumption of the strategic grades of block and film mica in the US represents 45 to 48 percent of the total consumed. For the Bloc a figure of 50 percent was assigned to block and film mica and a like percentage to mica splittings.

The estimate for the total labor force, the breakdown by types of workers, and the additional workers required to reach self-sufficiency was made in the following manner. Taking into consideration the reports of a few mines giving the number of men employed and the quantity of mica produced, the average number of men employed and the average quantity mined was calculated. 33/ The average quantity of mica mined divided by the average number of men employed gave a factor

\* P. 13, above.

\*\* P. 14, above.

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of the average quantity of mica produced per man. This factor was divided into the total estimated output of mica to obtain the total manpower employed. The breakdown by type of workers in each category was based on US analogy. The US analogy was modified by the analyst, in the light of his knowledge of the mica industry, to apply to Soviet conditions. In making this modification, the analyst took into consideration the excessive number of unskilled prison laborers, technical advisers, inspectors, and political agents usually employed in Soviet operations. The estimate of additional workers required to reach self-sufficiency in mica production within the Soviet Bloc is based on the geologic occurrence of mica and on current recovery methods. Mica deposits are, for the most part, small and are scattered over wide areas. Mining and processing methods often are not very efficient, and in many regions both mining and processing are seasonal operations. During some periods, relatively large numbers of men are employed and at other times only a few. Thus the estimated requirement of doubling manpower to achieve self-sufficiency is at best only a rough approximation.

The classification of mica uses as essential, less essential, and nonessential was made in the following manner. Previous surveys by the analyst covered the uses of mica in all the major mica-consuming countries of the world outside the Soviet Bloc. Sources covered in the present study of the uses of mica in the USSR indicate that the Soviet pattern of use follows that of the uses reported for the countries outside the Bloc, and therefore the list of uses shown is the same as that reported for the US.

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APPENDIX D

GAPS IN INTELLIGENCE

Reasonably accurate information is available on the sources and possible unmined reserves of mica in the USSR. Little reliable material is available on sources and reserves in China and Rumania. On the basis of general geologic knowledge, resources are not believed to be large in these countries. The largest gaps are accurate production figures, by qualities and sizes, and the percentage of finished material recovered from the raw block produced; consumption requirements by type, grade, quality, and size of sheet and film mica and mica splittings; and statistics on trade and stocks of the various grades and qualities of processed mica.

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APPENDIX E

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

<u>Source of Information</u>	<u>Information</u>
Doc.- Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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